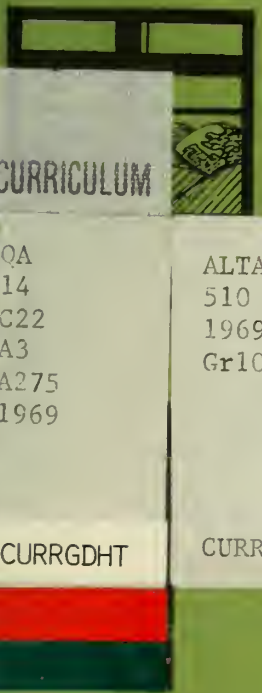
Curriculum Guide

for

MATHEMATICS 15

MATHEMATICS 25



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DEPARTMENT OF EDUCATION
EDMONTON, ALBERTA
SEPTEMBER, 1969

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Introduction

During the past decade, there has been a great increase in the number of students going into the senior high schools. In the past, the high school was designed to serve a "select" segment of our school population. Present thinking and practice seem to indicate that the high schools must serve all Alberta youth. Hence, it has become vitally necessary to build programs in all areas of curriculum that will serve students of varying abilities and interests.

With the number of students in secondary mathematics on the increase, and with the objectives of secondary mathematics in mind, a three-level stream of mathematics is envisioned for the high schools of Alberta. This three-stream program includes a course sequence for students who have experienced difficulties in past mathematics courses, a course sequence of medium difficulty, and a course sequence for the most able students. The Mathematics 15 - 25 sequence has been designed as a program for the students of low achievement.

In the past, many students have not attained a measure of success due to the difficulty of the material in relation to their ability, to lack of motivation, to ineffective work habits, and to the rigidity of course organization. This course is an attempt to overcome some of these factors by allowing flexibility in the choice of content, in time allocations, and by encouraging the use of a wide variety of instructional techniques. The standards must be set by the capabilities of the students.

Much of the success of this program will depend upon the teacher. It is hoped that the teacher will be an understanding person, concerned with the development of students who are experiencing difficulty in mathematics, and one who recognizes the problems involved in this area of teaching. For maximum success, the teacher must be willing to try new ideas, and to learn from his students as well as from his colleagues. He must be sensitive to the needs of the students.

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Acknowledgement

The Department of Education acknowledges with appreciation the contributions of the following members of the Mathematics 15 - 25 Ad Hoc Committee to the preparation of this Curriculum Guide for Mathematics 15 and 25. The Ad Hoc Committee has operated under the guidance of the Secondary School Mathematics Committee, and the Secondary School Board.

Mathematics 15 - 25 Ad Hoc Committee Members:

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Grateful acknowledgement of assistance is tendered teachers of Mathematics 15 and 25 experimental classes.

NOTE:

This Curriculum Guide is a service publication only. The information is prescriptive only insofar as the content of the Guide duplicates that contained in the Program of Studies for Senior High Schools of Alberta. The Curriculum Guide contains, as well as content, methods of developing the concepts, suggestions for the use of teaching aids, and lists of additional reference material.

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Mathematics 15 - 25

General Statement:

General Objectives

1. To develop an understanding of mathematics as a creation of man and to develop an appreciation of the contribution of this discipline to the progress of civilization.

2. To develop precision in thought and expression.

3. To develop and maintain an understanding of the operations and concepts of mathematics.

4. To develop and maintain skill in mathematical operations.

5. To develop powers of logical analysis of problems and of presenting their solution in a clear and precise manner.

6. To develop mathematics as a way of thinking as well as a way of computation.

Specific Objectives

1. To extend the student's knowledge of mathematical operations and his ability to apply these.

2. A revitalization of interest in mathematics through successful experiences at the student's level of understanding and through the use of novel approaches.

3. To develop an appreciation of mathematics as a living, growing, and changing area of work.

Mathematics 15

Text: Kinney, Ruble, Brown, *General Mathematics, A Problem Solving Approach*, Book One, Holt, Rinehart and Winston, 1967.

Course Outline:

The following topics should be considered as a suggested list only. Teachers should feel free to modify the program to suit the needs and interests of their students. Such modification may include the deletion and/or addition of certain topics. In cases where students will follow the Mathematics 15 - 25 sequence, attention should be given to those topics of Mathematics 15 which are considered as desirable preparation for Mathematics 25. Not all topics listed are treated in the recommended texts. Teachers should consult the reference section (p. 4) for resource materials.

1. Numeration systems.

2. Basic Algebra:

   (a) Natural numbers, integers, fractions, and rational numbers
   (b) Ratio and Proportion
   (c) Equations
   (d) Problem solving through equations

3. Geometry:

   (a) Measurement
   (b) Similarity
   (c) Congruence

4. Probability.

5. Business Mathematics:

   (a) Interest
   (b) Commission
   (c) Profit and Loss
   (d) Banking services
   (e) Insurance
   (f) Payroll

6. Statistics - Presentation and interpretation of data.

Mathematics 25

Text: Kinney, Ruble, Brown, *General Mathematics, A Problem Solving Approach*, Book Two, Holt, Rinehart and Winston, 1968.

Course Outline:

The following topics should be considered as a suggested list only. Teachers should feel free to modify the program to suit the needs and interests of their students. Such modification may include the deletion and/or addition of certain topics. Not all topics listed are treated in the recommended texts. Teachers should consult the reference section (p. 4).

1. Basic Algebra:
   - (a) Equations (2 variables)
   - (b) Graphs (2 variables)
   - (c) Square Roots (tables)
   - (d) Problem Solving
   - (e) Exponents

2. Geometry and Trigonometry:
   - (a) Symmetry
   - (b) Right triangle and Pythagorean relation
   - (c) Space
   - (d) Trigonometric ratios

3. Management of Personal Property
   - (a) Stocks, Bonds, and Investments
   - (b) Automobile
   - (c) Real Estate
   - (d) Taxation
   - (e) Consumer Credit

4. Application of Mathematics principles to
   - (a) Construction
   - (b) Sheet Metal
   - (c) Electricity
   - (d) Food Preparation
   - (e) Machine Shop

References

The following are a few of the many titles recommended for the mathematics library. The books and materials listed are expecially appropriate for the Mathematics 15 - 25 program. For additional references see the "Curriculum Guide for Mathematics 10", September, 1965.

-For Student Use-

Attridge, D. et al. *ASTC Mathematics Book 1*, Ginn and Co., Toronto, 1966. 470 p.
Chapter 13 : Relations and Graphs
Chapter 14 : Mathematics in Business
Chapter 15 : Banking and Interest

Attridge, D. et al. *ASTC Mathematics Book 2*, Ginn and Co., Toronto, 1968. 470 p.
Chapter 6 : Presentation and Interpretation of Data
Chapter 7 : Ratio, Proportion and Variation
Chapter 8 : Purchasing Personal Property
Chapter 9 : Managing Personal Property
Chapter 10 : Payroll Preparation

Bonham, G. et al. *Mathematics for Today 10*, J. M. Dent and Sons (Canada) Ltd., Toronto, 1968. 352 p.
Chapter 6 : Managing Personal Property
Chapter 7 : Payroll
(Other chapters are appropriate also.)

Dodes, I., *Mathematics A Liberal Approach*, Hayden Book Co. Inc., New York, 1964. 420 p.
Chapter 7 : The Math Laboratory
Chapter 9 : Indirect Measurement
Chapter 10 : Advertising, Editorials and Logical Thinking
Chapter 11 : Modern Problems In Mathematics

Experiences in Mathematical Discovery, National Council of Teachers of Mathematics, Washington, D. C., 1967.
Five separate Units as follows:

Unit 1 : Formulas, Graphs, and Patterns	60 p.
Unit 2 : Properties of Operations with Numbers	38 p.
Unit 3 : Mathematical Sentences	35 p.
Unit 4 : Geometry	98 p.
Unit 5 : Arrangement and Selection	130 p.
Answers for Units 1-5	129 p.

Groenendyk, E. and T. Shoemaker, *Experimental Ninth Grade General Mathematics Teacher's Handbook*, Central University of Iowa Press, Pella, Iowa, 1965. 169 pp. (Mimeographed, Looseleaf, Laboratory Approach)

Hogsden, L. *The Wonderful World of Mathematics*, Garden City Books, New York, 1955. 69 pp.

Johnson, D., W. Glen, *Exploring Mathematics on Your Own*, Webster Publishing Co., St. Louis, 1961. (Available from McGraw-Hill Publishing Co., Toronto.)
Twelve separate booklets as follows:
- Sets, Sentences, and Operations
- The Pythagorean Theorem
- Invitation to Mathematics
- Understanding Numeration Systems
- Fun With Mathematics
- Number Patterns
- Topology - The Rubber-Sheet Geometry
- The World of Statistics
- Short Cuts in Computing
- The World of Measurement
- Adventures in Graphing
- Computing Devices

Johnson, D. *Paper Folding*, National Council of Teachers of Mathematics, Washington, D. C., 1957. 32 pp. (Some interesting approaches to geometric concepts)

Lindsay, H. et al. *Trouble Shooting Mathematics Skills*, Holt, Rinehart and Winston of Canada, Ltd., Toronto, 1966. 375 pp. (Material will help teacher diagnose difficulties. Contains other suitable material from business world.)

Managing Personal Property, Copp Clark Publishing Co., Toronto, 1968. 64 pp.
(A unit expecially useful for Business Education students.)

Massing, O. and G. Sanders, *Fundamentals of Technical Mathematics*, McGraw-Hill, Toronto, 1967. 398 pp.
(Chapters 18, 19 - Measurement, Areas, Volumes and Measurement Applications.)

Mumford, D. L. and H. L. Ridge, *An Introduction to Probability*, Copp Clark Publishing Co., Toronto, 1968. 86 pp.

Payroll, Copp Clark Publishing Co., Toronto, 1968. 51 pp.
(A unit expecially useful for Business Education students.)

Peters, Schaaf, *Algebra, A Modern Approach, Book 1*, Second Edition
D. Van Nostrand Co. Inc., Toronto, 1968. 649 pp.
(Contains specific suggestions on use of the library.)

Piper, Gruber, Milne, *Applied Business Mathematics*, W. J. Gage, Ltd.
Toronto, 1967. 578 pp. (A comprehensive book on business mathematics)
Retriev-O-Math, Midwest Publications Co. Inc.
P. O. Box 307, Birmingham, Mich. 48012
(A set of 76 assignment cards with a teacher's manual.)

Ripley and Tait, *Mathematics Enrichment*, Copp Clark Publishing Co.
Toronto, Ontario.
(Suggested activities and problems for enrichment.)

Sets, Probability and Statistics, Canadian Life Insurance Assoc.,
Educational Division, Toronto, 1968. 35 pp.
(A free student workbook. There are ten other booklets in the Life Insurance field available free in classroom sets.)

Smith, Eugene and J. Hursch, *Computer Mathematics 1*, Student's Text,
Midwest Publications Co., Birmingham, Mich., 1966. 40 pp.
Teacher's manual to the above.
(An elementary introduction to computers through student participation.)

Stover, D. *Stereograms*, Houghton Mifflin Co., Boston, 1966. 44 pp.
(Explains and shows how to make stereograms.)

Wenninger, M. J. *Polyhedron Models for the Classroom*, National Council
of Teachers of Mathematics, Washington, D. C., 1966. 43 pp.
(Shows construction details of Platonic, Archimeadian, Stellated, and other solids.)

Wiebe, A. and J. Dean, *Foundations of Mathematics*, Holt, Rinehart and
Winston of Canada, Ltd., 1965. 438 pp. (Contains open-end problems and laboratory approach)

Zimmerman, J., *Low Achiever Motivational Project*, Des Moines Public Schools,
Des Moines, Iowa, 1968. (A laboratory approach, Mimeographed, Looseleaf.)

-For Teacher Use-

Biggs, E. E. and J. R., MacLean, *Freedom to Learn,* Addison-Wesley (Canada) Ltd., Don Mills, Ontario. 205 pp.
(A book on how to plan, start, carry out and assess active learning in mathematics.)

Elliott, H. A. et al., *Geometry in the Classroom: New Concepts and Methods,* Holt, Rinehart and Winston of Canada, Ltd., Toronto, 1968.
(Some modern concepts in an elementary presentation.)

Elliott, H. A., *Numbers, Shapes, and Patterns,* Holt, Rinehart and Winston of Canada, 1968.

Fletcher, T. J., *Some Lessons in Mathematics,* Cambridge University Press, New York, 1964.
(Contains ideas for lesson planning and content.)

Growth of Mathematical Ideas, 24th Yearbook, National Council of Teachers of Mathematics, Washington, D. C.
(Topics covered for Grades K-12.)

Johnson, D. and G. Rising, *Guidelines For Teaching Mathematics,* Wadsworth Publishing Co. Inc., Belmont, Calif., 1967. 446 pp. (A resource book for new ideas and approaches to teaching mathematics.)

Kinney, Ruble, Brown, *General Mathematics, A Problem Solving Approach, Book 1,* Holt, Rinehart and Winston, Inc., Toronto, 1968.
(Teacher's Edition)

Kinney, Ruble, Brown, *General Mathematics, A Problem Solving Approach, Book 2,* Holt, Rinehart and Winston, Inc., Toronto, 1968.
(Teacher's Edition)

Mumford, D. L. and H. L. Ridge, *An Introduction to Probability - Teacher's Guide,* Copp Clark Publishing Co., Toronto, 1968. 116 pp.

Instructional Materials

Tuf The Superlative Numbers Games,
P. O. Box 173
Rowayton, Conn. 06853

The following games are available from:
WFF'N PROOF
P. O. Box 71
New Haven, Conn.

WFF The Beginner's Game of Modern Logic
The Real Numbers Game
Equations: The Game of Creative Mathematics
Tac-Tickle: A Challenging Game of Pure Strategy

The following sets of posters are available from:

J. Weston Walch, Publisher
Box 658
Portland, Maine

Number Novelties by L. G. Brandes

A probability kit is available from:

Mat-Master
Division of Gamco Industries
Box 310
Big Spring, Texas

Periodicals

The Arithmetic Teacher
The Mathematics Teacher

Available from: N.C.T.M.
1201 - 16 Street N. W.
Washington, D. C.

School Science and Mathematics
P. O. Box 408
Oak Park, Illinois

Suggestions for the Teacher of

Mathematics 15 and 25

This section is divided into three general areas:

(a) General Suggestions
(b) Methods
(c) Reading in the Content

A. General Suggestions

1. Teachers of Mathematics 15 - 25 classes should have an interest in the students in these classes and be aware of their past difficulties. The emphasis in these courses should be on individual student differences and needs rather than course content.

2. Teachers should plan their program only after determining the interests, needs, and capabilities of their students.

3. Time allotments in the course outlines have been intentionally omitted to allow for maximum flexibility. This flexibility enables teachers to discontinue the study of a topic when interest wanes and provides opportunity for innovation and pursuit of special interest areas.

4. The basic premise of this course is the participation of students in the learning process. To facilitate this participation, the laboratory approach should be implemented whenever possible. A mathematics laboratory has been defined as a state of mind. A questioning atmosphere and a continuous involvement with problem-solving situations should be characteristic of this approach. The teacher strives to create an environment suitable for learning through experimentation and active participation by the students.

5. Each student should experience success. Success builds interest, motivates and reduces discipline problems. This does not imply that the work must be simple or of lowest common denominator for the class, but it does imply that the development of mathematical concepts should be gradual, systematic, and meaningful.

6. Since some students learn better through physical activity, and through activities which are closely related to relevant problems, it is hoped teachers will draw on the human and physical resources of the Business Education and Technical-Vocational Departments of their school when applicable.

7. In the physical plant, the laboratory approach may be incorporated, as resources permit, along the following guidelines:

   (a) replace desks with tables to facilitate group projects and experimentation;

   (b) use paper-folding, scissors, paper, glue, etc. to teach geometric concepts;

   (c) use abaci for teaching numeration systems;

   (d) use playing cards, dice, marbles, probability kits for the concepts of sets and probability;

   (e) use calculators, slide rules, tables as computational aides;

   (f) use puzzles, pamphlets, games for motivation, master skills, and concepts, interest and recreation;

   (g) flow charts are useful for the development of solutions to problems;

   (h) challenge and activity cards help to meet individual differences especially for the more able students. These cards can be developed in the school;

   (i) audio-visual aides such as films, film strips, and overhead projectors can create and maintain interest as well as aid in the understanding of concepts;

   (j) use of local resources; petition local business and industrial concerns for typical mathematical problems encountered in their daily routines. Permission to use the business letterheads creates realism.

8. Computational skill, while desirable, should not be over-emphasized at the expense of student interest. These points relative to the development of computational skills, might be kept in mind:

   (a) diagnosis of areas of student difficulty should precede practice;

   (b) practice should make use of novel approaches by using cross-number puzzles, games such as *"Tuf", "Krypts", "Napier Bones"*, etc. Calculators can be used to improve computational competency as well as to free students from routine maniuplations in order to concentrate on problem situations.

9. The teacher should plan the activities so that very few, if any, home assignments are necessary.

10. Each student may be supplied with a file folder (kept in a filing cabinet in the classroom) in which his daily work is placed. A check-off list of assignments on the front of the folder assists in keeping track of work done, yet motivates the student. The fact that the daily work is on file rather than discarded gives the student a feeling the work is of value.

B. Methods

This guide presents the following teaching suggestions since the success of the Mathematics 15 and 25 programs will depend to a great extent on the teacher's ability to use a variety of interesting methods in which students are actively involved. This is especially essential in the longer semester classes. The teacher is encouraged to plan his lessons imaginatively. In one class, the teacher may use several activities. Some of the many activities are listed:

(a) presentation of a lesson by a teacher

(b) teacher guided inquiry lesson

(c) class or group discussions

(d) a related film or general interest film

(e) small group experimentation on problems

(f) guided study using reference booklets

(g) model building

(h) assignment directed around the calculator

(i) concept developed through use of calculator

(j) assignments from text

(k) worksheet assignment

(l) puzzles, games, cross-number puzzles

(m) flow-charting non-mathematical problems

(n) flow-charting mathematical problems

(o) practical problems from industry and business

(p) related field trips (e.g., indirect measurement)

(q) lessons built around calculation aids such as Napier's bones, logarithms, slide rule, etc.

(r) open-ended problems

All planning should make allowances for individual student differences. Providing the student with the opportunity to choose between the set of easier problems and the set of harder problems encourages the student to be honest about his own ability.

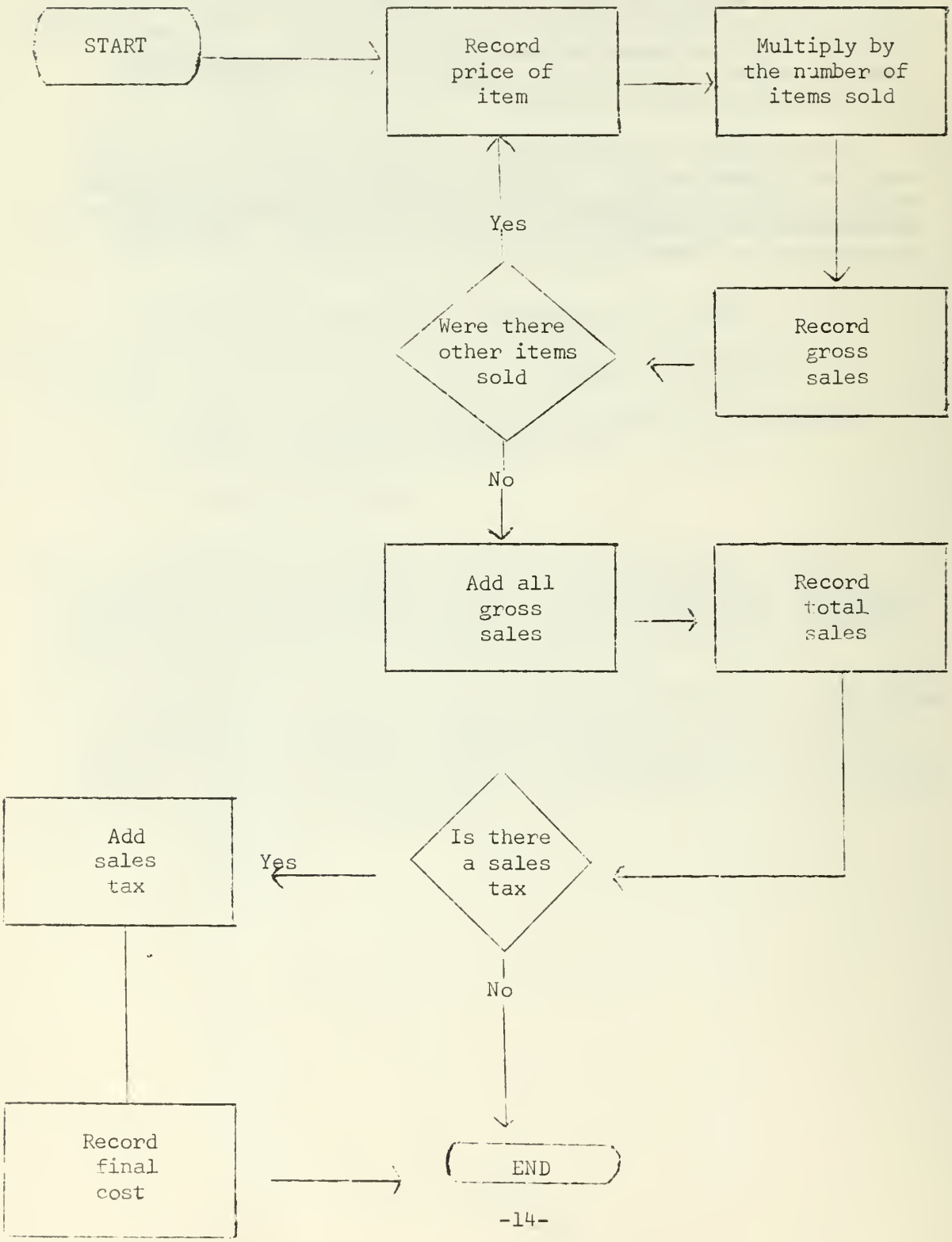
Two examples of the use of flow charts are given here. The first, a non-mathematical problem designed to build the concept of flow-charting while the second is a mathematical solution to a practical problem. Several of the references use flow-charting as an integral part of the mathematics program.

C. Reading in Mathematics

The mathematics teacher is urged to stude the *Secondary School Reading Handbook* (Curriculum Branch, September, 1969). Specific reference is made to mathematics in Chapter V "Reading in the Content Field" section titled "Reading in the Mathematics". This section deals with the skills required for reading in mathematics, suggested teaching techniques and student activities, and suggested teacher references and resource material.

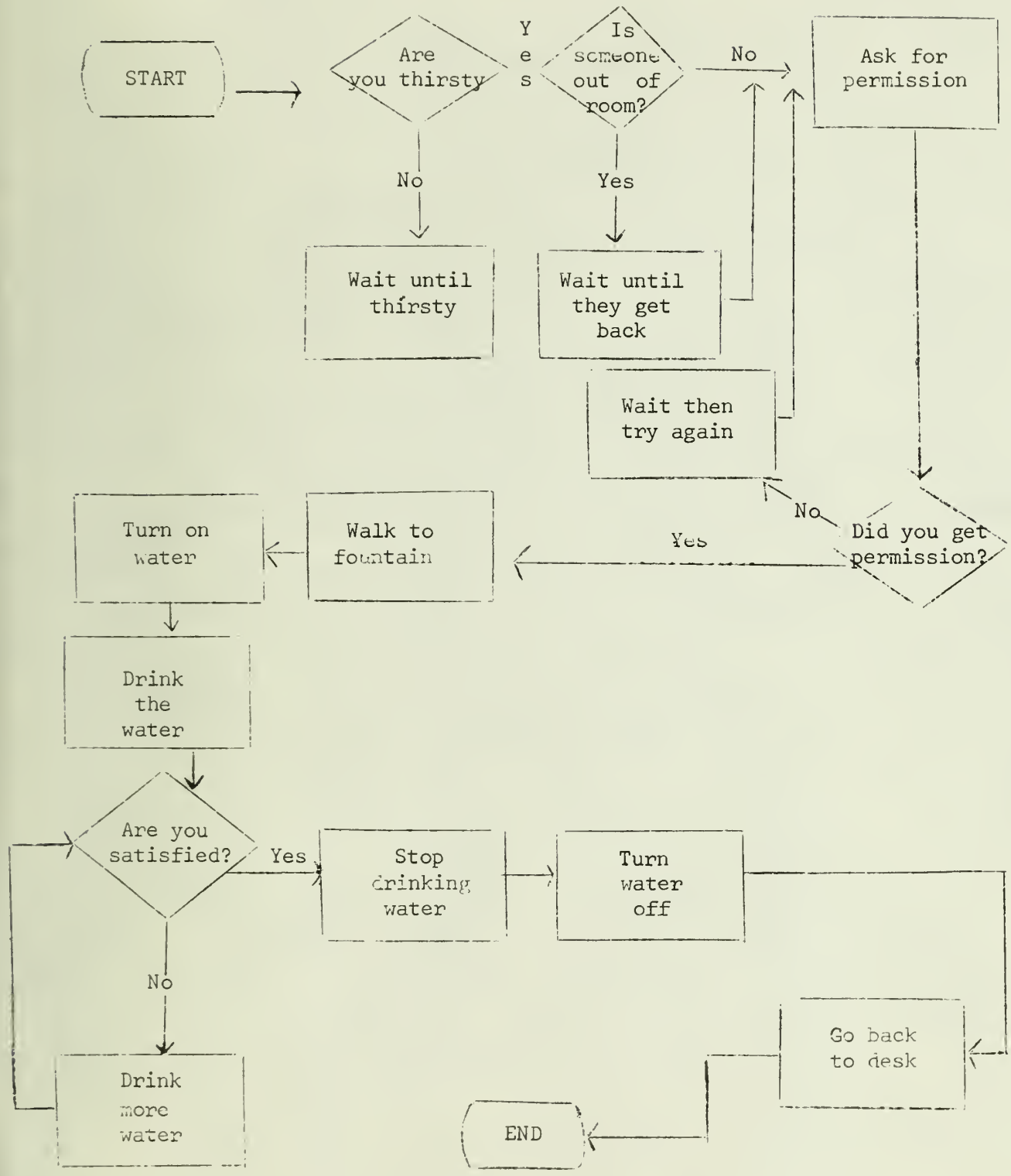
While students in Mathematics 15 and Mathematics 25 generally have low reading ability, they may, in fact, improve this skill as well as mathematical skills when provided with suitable materials in mathematics of appropriate difficulty and interest. Motivation and success are essential.

Flow Chart For Determining Total Sales



Getting A Drink Of Water

(Main Ideas With Detail)



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